

**REMARKS**

The Examiner's comments together with the cited references have been carefully studied. Favorable reconsideration in view of the foregoing amendments and following remarks is respectfully requested.

Claims 1-19 are pending in the application. Claims 1-18 have been rejected. Claim 19 has been withdrawn from consideration. Claims 1, 12, and 18 herewith are amended. Claims 1 to 18 are, therefore, presently active. Favorable reconsideration of the application in view of the following remarks is respectfully requested

Affirmation is hereby made of the election, with traverse, to prosecute the invention of Group I, claims 1-18.

Applicants herewith file terminal disclaimers (3) in compliance with 37 CFR 1.321(c) to overcome provisional double patenting rejections based on a nonstatutory double patenting ground.

Claim 12 stands rejected under 35 U.S.C. §112, second paragraph. Applicants respectfully submit that the amendments to Claim 12 are in accordance with the Examiner's comments in the Office Action. These amendments are now believed to conform the claims to the requirements of the rules.

Claims 1-8 and 10-18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Liu et al. in view of Ohashi et al. The Examiner states that the primary reference discloses an inkjet recording element comprising an ink-receiving layer that comprises a binder and pigment particles, which particles may be aluminosilicate and have an amorphous structure that may be produced by subjecting a mixture containing aluminum alkoxide and silica alkoxide to hydrolysis. The Examiner notes that the particles have a ratio of alumina to silica of 1:4 to 4:1, a primary particle size of 3 to 40 nm, and a secondary particle size of 10 to 300 nm. The reference discloses a ratio of binder to pigment of 10:2 to 10:6. The Examiner further states, that "...it would have been obvious to one of ordinary skill in the ink jet recording art to look to the field of inorganic pigments used in a variety of uses, including as catalyst carriers, for a particular material." The Examiner also states, "...it would have been obvious to one of ordinary skill in the art to

include the particular aluminosilicate of the secondary reference as the aluminosilicate of the primary reference.”

This rejection is respectfully traversed. Importantly, the present invention is directed to a non-porous ink-receiving layer of an inkjet recording element. Such recording elements, which comprise one or more non-porous (swellable) hydrophilic absorbing layers, exhibit improved humidity keeping and excellent image quality.

In distinct contrast, the inkjet recording element of Liu et al. is porous. A porous image-receiving layer typically contains interconnecting voids to provide a pathway for an ink to penetrate into the substrate by capillary action, thus allowing the substrate to contribute to the dry time. A non-porous image-receiving layer, in contrast, requires diffusion of the ink through a non-voided layer. The difference between porous and non-porous media, and layers thereof, is well known in the art and represents a clear dividing line.

The fact that Liu et al. is directed to a porous media is evident from the description. See for, example, Fig. 1 of Liu et al. in which pore radius and pore volume are described, which pores are characteristic of porous media. Similarly, in col. 13, lines 31-47, Liu et al. states that “the ink receiving layer includes a plurality of pores formed therein, the total volume of all pores is 0.6 ml/g, more preferably 1 ml/g.... etc.” In contrast, it is not possible to measure the porosity, by BET or mercury porosimetry, of the present invention.

In order to obtain a porous layer, the pigment concentration must be sufficiently larger than the binder concentration; otherwise the particles will be dispersed or scattered within the polymer matrix and, hence, unable to form pores between the particles. In Example I-9, column 24, of Liu et al., the aluminosilicate particles are used in an amount of 60 percent by weight in the ink-receiving layer, which is sufficient to provide a porous layer. In contrast, the examples of the present invention, the aluminosilicate particles are used in the amount of 10 weight percent, as characteristic of a non-porous layer. In the present invention, the ratio of hydrophilic binder to synthetic, substantially amorphous aluminosilicate particles is about from about 95:5 to about 75:25, although the preferred amount of particles is 10 to 18% by solids of the ink receiving layer, as indicated on page 9, lines 20-23, of the present specification. Thus, the examples in the present invention use only 25% of

the amount of particles used in the examples of Liu et al., and the preferred range in the present invention (10 to 18 percent) is lower than the preferred range of Liu et al. (10:2 to 10:6).

In summary of the above, and in light of all the evidence, the present claim 1 are limited to a “non-porous ink-receiving layer,” whereas Liu et al. clearly teaches and describes a porous ink-receiving layer.

Furthermore, Liu et al. requires a haze range of 4% to 65%. They claim that if the haze is less than 4%, there is insufficient ink-absorbing capacity and ink-absorbing rate. In contrast, Applicants’ examples fall outside this haze range. In fact, one of the present inventors measured the haze value, according to the test procedure defined by Liu et al., of a coating made exactly in accordance with the working example in the present application, referred to as Invention 1 in Table, on page 22 of the present application. Applicants’ coating fell significantly below the lower acceptable limit set by Liu et al.

Liu et al. states, in column 14, lines 55 to 58, as follows:

If the haze value is less than 4%, although the resultant ink-receiving layer may exhibit an enhanced transparency, the ink-absorbing rate and ink-absorption capacity of the ink-receiving layer may be unsatisfactory...The haze value of the ink-receiving layer is variable depending not only on the secondary particle size but also on the primary particle size of the silica and/or aluminosilicate colloidal particles...Also, the haze value of the ink-receiving layer is variable depending on the amount and refractive index of the binder.

It is surmised that the use of agglomerated aluminosilicates by Liu et al. creates porosity in the ink-receiving layer that results in a minimum level of haze of no lower than 4. If the haze falls lower, insufficient porosity and ink absorption rate is lacking for the porous ink-receiving layer of Liu et al.

Furthermore, it is submitted that the aluminosilicate of Liu et al. is not the special type of aluminosilicate required by the claims of the present invention, which aluminosilicate is characterized by an X-ray diffraction pattern that comprises weak peaks at about 2.2 and 3.3 Å, such as characteristic of synthetic allophane. Applicants’ aluminosilicate material comprises spherical particles about 5 nm in size, resulting from a carefully controlled synthetic pathway.

In particular, the synthesis of aluminosilicate by Liu et al. does not allow the aluminosilicate materials of the present invention to be formed. The starting materials of Liu et al. are only alkoxides of aluminum and silicium, followed by a hydrolysis "procedure." Moreover, the experimental synthesis of Liu et al. is carried out in alcohol. After the hydrolysis, a heterogeneous gel similar to a silica gel but made of  $\text{SiO}_2$  and  $\text{Al}_2\text{O}_3$  is formed. Chemically speaking, it is a mixture of  $\text{Al}_2\text{O}_3$  and  $\text{SiO}_2$ , not a true aluminosilicate material based on the repetition of Al-O-Si entities. The composition in Al and Si and the synthetic pathway has to be strictly followed in order to obtain a true aluminosilicate instead of a mixture of alumina and silica ( $\text{Al}_2\text{O}_3$  and  $\text{SiO}_2$ ).

To make synthetic allophane, as in the present invention, the right amount of silicium alkoxide is mixed with an aluminum salt (chloride, perchlorate, or nitrate) or halogenoalkoxide species. This initial step has to be strictly controlled in terms of time of process. The silicium alkoxide will start to hydrolyze, forming small oligomers, while the aluminum salt is only hydrated but still a salt due to pH which has to be very acidic.

There are probably more than several hundred true aluminosilicates (phyllosilicate order ) described today in the geological literature, covering all possible ratios Al/Si . The ratio Al/Si is not the key point for specifying an aluminosilicate. Accordingly, the present claims are defined in terms of an X-ray diffraction pattern that comprises weak peaks at about 2.2 and 3.3 Å. Other useful methods of characterizing a true aluminosilicate include Raman fingerprints and mass spectra. Raman fingerprints of Applicants' aluminosilicate show a distinctive structure and mass spectra indicate specific peaks of "true" aluminosilicate species unlike the teaching of Liu et al.

Furthermore, the synthesis of the aluminosilicate particles in Liu et al., which involves subjecting aluminum alkoxide and silicon alkoxide to a hydrolysis procedure in an alcoholic atmosphere, results in particles having a secondary particle size on the order of microns, which particles have to be mechanically divided in water down to 10 nm to 300 nm, as measured by SEM or TEM. Because Applicants' aluminosilicate particles, such as synthetic allophane, are formed as smaller particles containing water and do not form pores in the ink-receiving layer, Applicants obtained a glossy layer that swells like a PVA or gelatin layer, due to water from the applied

ink surrounding individual particles of the synthetic aluminosilicate. Since Applicants' synthetic allophane particles are saturated with water when making the coating solution, this also explains why swellable, non-porous coatings are obtained. (Synthetic allophane particles, for example, are believed to be hollow spheres containing water, so they cannot be dried, even with supercritical washing.)

Ohashi et al. disclose a spherical hollow aluminosilicate which appears to meet all the limitations of the aluminosilicate as instantly claimed. (Ohashi et al. was disclosed and discussed on page 4 of the present specification.) As noted by the Examiner, the uses specifically disclosed by Ohashi et al. include "adsorbent [not of ink, but of hazardous substances], humidity adjuster [not of inkjet media, but for controlling the humidity of living rooms, car interiors and other living environments] , drug microcapsules and catalyst carriers." Other uses mentioned by Ohashi et al. include detergents, deodorants, and a wide variety of other commercial applications. Inkjet recording elements are not mentioned, nor remotely suggested.

The Examiner notes that Ohashi et al. disclose desirable properties such as excellent water resistance and high specific area. Ohashi et al. also mention heat resistance and corrosion resistance. Applicants note that water resistance prior to imaging would not be a desirable characteristic of inkjet media. Corrosion and heat resistance would not be relevant to an inkjet recording element. The relevance of high specific area, in a synthetic allophane, to a non-porous ink-receiving layer is not remotely suggested or taught by Ohashi et al.

As conceded by the Examiner, Ohashi et al. do not mention the use of synthetic allophane in ink receptive layers. The Examiner however cites Greenwood et al. (6,596,250) and Watanabe (6,632,489) for the proposition that inorganic oxides used as catalyst carriers are generally useful in the inkjet recording field as well. However, Watanabe et al. and Greenwood et al. disclose the use of a silica sol that is remote from the present synthetic allophane type of material. Such silica sols are useful for making concrete and mortar as well, as discussed by Greenwood et al., but that does not mean materials used in concrete are obvious to use in inkjet recording materials. Obvious to try is not the standard for patentability. There are

thousands upon thousands of patents disclosing the use of various inorganic particles in inkjet media. Yet, the Examiner cannot point to a single one mentioning the use of synthetic allophane, let alone the use of synthetic allophane in a non-porous inkjet media as claimed herein. Clearly, there is a host of less expensive inorganic particles that are readily available for use in an inkjet recording element. The skilled artisan has no need or reason to select the particular aluminosilicate used in the present invention.

Moreover, even assuming arguendo that the present invention were possibly obvious, rather than “obvious to try” based on hindsight, Ohashi et al. nowhere remotely suggest that the aluminosilicate used in the present invention would provide a much lower total Delta E color shift and Delta E max color shift, after prints made using the present inkjet recording elements are exposed to heat and humidity. This is clearly shown in Table 1 on page 22 of the present specification.

In view thereof, it follows that the subject matter of the claims would not have been obvious of Liu et al. in view of Ohashi et al. at the time the invention was made.

Claims 1, 8 and 9 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Liu et al. in view of Ohashi et al. as applied to claims 1-8 and 10-18 above, and further in view of Sunderrajan et al. The Examiner states that Sunderrajan et al. teach mordants for inclusion in inkjet recording elements. The Examiner alleges that “...it would have been obvious to one of ordinary skill in the art to include such an agent from those conventional and well known in the art for its concomitant function therein.”

Applicants take the position that claims 1, 8, and 9 are unobvious for the reasons provided above. In addition, Sunderrajan et al. teach mordants for inclusion in a porous inkjet recording in which the inorganic pigment is kaolin clay, calcined clay, titanium dioxide, talc, or a silicate”.... wherein “the amount of inorganic, anionic pigment used may range from about 50% to 95% of the image-receiving layer.” In contrast, the aluminosilicate of the present invention is not an anionic pigment, but rather exhibits a positive zeta potential as characteristic of alumina materials. Even if Sunderrajan were combined with Liu et al., the result would be a porous

inkjet recording element and emphatically teach away from the non-porous ink-receiving layer of the present invention.

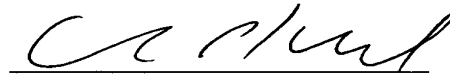
In view thereof, it follows that the subject matter of the claims would not have been obvious of Liu et al. in view of Ohashi et al. and further in view of Sunderrajan et al. at the time the invention was made.

Applicants have reviewed the prior art made of record and believe that singly or in any suitable combination, they do not render Applicants' claimed invention unpatentable.

In view of the foregoing remarks and amendment, the claims are now believed allowable and such favorable action is courteously solicited.

Should the Examiner consider that additional amendments are necessary to place the application in condition for allowance, the favor is requested of a telephone call to the undersigned counsel for the purpose of discussing such amendments.

Respectfully submitted,



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